MedicalXpress

Songbirds help scientists develop cooling technique to safely map the human brain

November 18 2014

A new diagnostic technique—resulting from monitoring thousands of courtship calls from songbirds—can be used to safely map the human brain during complex neurosurgery, according to research from Neuroscientists at NYU Langone Medical Center and elsewhere.

The mapping process, first tested in zebra finches, involves gently placing a miniature electrical cooling device at different locations on a small region of the songbirds' brains. This slows down processing of complex neural behaviors, such as a birdsong or human speech.

In a report prepared for the Society for Neuroscience annual meeting in Washington, D.C., on Nov. 18, the NYU Langone researchers and their colleagues at the University of Iowa describe how such "focal intraoperative cooling," first studied in the songbirds, was then safely applied in 18 volunteer participants undergoing brain surgery.

According to lead study investigator Michael Long, PhD, an assistant professor at NYU Langone, the standard practice is to keep many patients—particularly those suffering from epilepsy and brain cancer—awake and talking while surgeons directly apply brief electrical currents to the patient's brain surface to mark any regions that, when shocked, impede normal speech.

Moreover for those with epilepsy, says Long, such electrical probes have been known to trigger seizures, adding risk to surgery.

"Our study results show that focal intraoperative cooling is a safe and effective means of mapping complex neural behaviors in the human brain, especially speech, and could be used as an alternative to current practices," says Long. "Our research also offers insight into how complex neural behaviors are produced, demonstrating that changes in speech are specific to particular regions of the brain."

As part of the research, study volunteers already scheduled for brain surgery underwent focal intraoperative cooling sessions that lasted about 20 minutes. This allowed researchers time to map the function of a half-dozen brain regions. To map each section, patients recited word lists, such as the days of the week, while researchers analyzed the structure and timing of the speech for such things as slurring and speed.

Results showed that the cooling sessions lowered regional brain temperatures by roughly 10 degrees Celsius, enabling researchers to track speech control to mostly the brain's left hemisphere, and slowing speech some 30 percent. Patients initially took four seconds to recite the weekday list, but needed longer than five seconds after cooling certain key regions of the brain.

Speech quality also varied when other brain areas were chilled, with patients mixing up the weekday order or slurring their pronunciation after cooling.

Long and his research team plan to expand their work to map more language-critical sites in the brain.

More information: This poster presentation, #637.04, at the American Society for Neuroscience meeting is titled "Focal intra-operative cooling modifies speech production in location-specific manner" and will be on display from 1p.m. to 5 p.m., Tuesday, Nov. 18, in Exhibit Halls A-C at the Washington Convention Center in Washington, D.C.